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No. 545

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TRANSLATIONS ON EASTERN EUROPE

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CONTENTS PAGE

BULGARIA

ADVANTAGES OF VARIOUS GRAIN VARIETIES STRESSED

Sofia RABOTNICHESKO DELO in Bulgarian 5 Jan 77 p 2

[Article by Professor Dimitur Kolev, Ph.D.: "Science Instead of Wishful Thinking"]

[Text] The grain producers are facing a great task. During the Seventh Five-Year Plan, the average wheat yield must reach 400 kg per decare and must overcome one more "barrier" in its development. The successes in wheat production during the Sixth Five-Year Plan and particularly during 1976, when Tolbukhin, Ruse, Razgrad, Pleven, Veliko-Turnovo, Shumen, Silistra, Plovdiv and Stara-Zagora okrugs gathered as an average over 400 kg per decare, show that the task is feasible. In order to fulfill this task, one must mobilize all efforts and use even the smallest still hidden reserves. We think that one of the reserves insufficiently utilized for increasing and stabilizing the yields is the correct variety structure, conforming to the specific soil and climatic conditions in the individual okrugs, APK (Agro-Industrial Complexes) and farms.

The grain variety is the only means of production which increases the yields without additional expenses. An inquiry concerning the increase in the average five-year plan yields after 1950, shows that from 1951 to 1965, when the basic varieties were "No 14" and "No 301," the yields increased from 147.6 to 181.1 kg, or, for each five-year plan by 15.5 and 18 kg respectively. The yields increased very drastically--by 93.2 kg compared to the preceding five-year plan, during the period from 1966 to 1970, at the time when the basic variety was "Bezostaya 1" which brought the wheat production to a new higher stage. Later on, besides "Bezostaya 1," the varieties "Avrora," "Kavkas," "Burgas 2," "Rusalka," "No 19--16," "Nadezhda 2" and others contributed also to the increase in yields.

The wheat output in 1976 is so far the highest in the history of wheat production. The merit in this achievement should fall to the variety "Sadovo 1" created in the agro-research station "K Malkov" in Sadovo, Plovdiv Okrug, by the team under the leadership of academician Pavel Popov. According to the data of the Ministry of Agriculture and Food Industry, this variety was most widely used in 1976. A certain role in the high yields also played the varieties "Levent," "Ludogorka," and "No 19--16" of the Institute for Wheat and Sunflower.

Together with the increased yields one notices also an accelerated replacement of the old with new varieties. While "No 14" held on for more than 3 decades, "No 301" lasted fewer than 10 years and "Bezostaya 1"--a little over 5 years. Is this process a natural development and what do the varieties represent? The variety should be looked upon as a biosystem, an aggregate of specimen with closely related morphological, biological and economic features which determine its shape and character. As a biosystem it interacts biologically with the environmental natural or man-made conditions; climate, soil fertility, diseases, insects, weeds, etc. Under natural conditions, following Darwin's theory of the natural selection of the species, the biosystem will thrive or die in the struggle for survival. Before the application of the selected varieties, complex generations were cultivated which had great morphological and biological specimen diversity and thus--had great resistance in the biosystem in the harsh natural environment.

In the present stage of increased intensification and constant increase in yield, the man-made conditions of increased fertilization, use of pesticides against diseases, insects and weeds, single crop cultivation, irrigation and others, modify quite drastically the biological balance to the detriment of the biosystem. Its resistance weakens rapidly and degenerates. The variety "grows old." This is due on the one hand to the discrepancy between the high requirements of the intensive varieties and the environmental conditions, and on the other hand--to the loss of resistance to the constantly emerging new diseases and insects. The process of aging, as some other researchers note as well, is totally natural and will increase faster in the future. Therefore, the task of creating varieties with greater flexibility and resistance will always be pertinent. Furthermore, the new varieties should possess an entire complex of useful features--adaptability to industrial cultivation (resistance to flattening and shedding), frost resistance, early ripening, high quality of the grain, etc.

The creation of new varieties is one side of the interrelation of the selection institutions with practice. The other side, not less important, is the fast adoption of the new achievements. The party and economic leaders as well as the specialists should possess a highly developed feeling towards the new, should look for perspective varieties still in the experimental fields, and should organize their production tests and propagate them quickly so that when the variety is approved and distributed, the practice will have the necessary seeds. The best example in this respect is the accelerated propagation and adoption of "Sadovo 1" before its official introduction.

Another just as important condition for increase and stabilization of the wheat yields is the creation of an adequate variety for the separate okrugs, agro-industrial complexes and grain producing enterprises. During the past few years several okrugs suffered considerable losses due to the idea to cultivate primarily only one variety. During 1971 and particularly in 1975 the fusariosis and powders mildew caused mass damages to "Rannaya 12," "Burgas 2," "Kavkas," and "Rusalka" and decreased considerably the wheat yields in the okrugs where those varieties were exclusively used.

The cultivation of only one or primarily one variety is unscientific due to the following circumstances: drought, drizzly weather, frost, dry wind, diseases and pests; difficulty adapting to the multitude of soil and climatic conditions of the individual settlements, let alone of entire agro-industrial complexes and okrugs; extraordinary tension during the gathering of the crops which is connected with great losses of seed; the need to have varieties with different biochemical content and flour richness necessary for bread production, etc.

Great scientific foresight with feasibly practical importance should be exercised in the classification of the varieties as basic--which will occupy large areas; secondary--for separate rayons and okrugs; and supplementary--with local importance. We refer here to a choice of the mentioned classifications, based on well known biological, physiological and economic qualities of the varieties, as well as on the data of the precise tests and production testing under specific conditions. It is a good idea for the variety structure to include some of the older good varieties which under extreme conditions could prove more stable in the yields. According to the Ministry of Agriculture and Food Industry, and the specialists at the "Agriculture" administration and at the agro-industrial complexes, the variety structure, scientifically based and with minimal influence by subjective factors and including the most suitable basic and supplementary varieties, will be a special buffer system against the risks of the unfavorable natural conditions and, as a whole, will have all advantages over a single variety.

The leaders and specialists at the agro-industrial complexes should participate more actively in the classification of the variety structure for the farms under their auspices. They will be able to do this more objectively by having at their disposal the data of the production testings of the new varieties under specific soil and climatic conditions. Therefore, we should not underestimate any longer the importance of the testing fields where the new achievements, offered by the selection institutions will be tested at an accelerated rate. The efforts in this respect will be greatly rewarded by an increase in the yields through correct distribution and adoption of varieties having good future prospects.

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EAST GERMANY

TELEMETRY SYSTEM FOR INTERCOSMOS RESEARCH SATELLITES DESCRIBED

East Berlin RADIO FERNSEHEN ELEKTRONIK in German No 4, Feb 77 pp 114-118

[Article by Helmut Canitz and Werner Steffen, of the Electronics Institute of the GDR Academy of Sciences: "Universal Telemetry System for Intercosmos Research Satellites"]

[Text] For years, research collectives of the socialist countries have taken part in space research in the framework of the Intercosmos program. The research goals are of remarkable variety. They are directed towards phenomena in the ionosphere, in the magnetosphere and on the Sun, as well as towards problems concerning a deeper knowledge of the Earth. These problems, which can be different in every experiment, require a high degree of flexibility and universality on the part of the telemetry systems installed to relay the information obtained. For this reason, and in order to be able to send the information as directly as possible to the countries taking part in the experiments, a telemetry system largely designed for these requirements was developed in international cooperation among the socialist countries. The telemetry system was successfully tested on the IK 15 satellite. The DDR contribution was the development of the data acquisition and processing complex of the digital tract, and the digital magnetic tape store. In the following contribution, the digital tract of the system is described in particular.

Characteristic Properties of the System

Depending upon the requirements, the information from the experiments can be transmitted by proportional methods -- that is, by an FM sub-carrier -- or in digital form. While a series of sub-carrier channels in the IRIG grid is available for proportional transmission, the digital tract in its basic form is arranged for more than 100 input channels, which are divided into channels for the transmission of switch information, channels for the transmission of the position of electronic counters, and channels for information in analog form. The number of input channels in the latter groups and their signal mixing

sequence can be changed by remote control or by a previously established program; this is especially important for flexible planning of the experiments.

The system can also work in five different modes (regimes) upon command from the control center: 1. acquisition and simultaneous transmission of the information received through the sub-carrier channels (analog or proportional mode); 2. acquisition and simultaneous transmission of the information received through the digital tract (direct digital mode); 3. uninterrupted data storage for a period of 64 min (rotating mode); 4. digital data storage in time intervals of 16 min each in the course of 24 h (diurnal mode); 5. transmission of the data stored in the rotating or diurnal mode in the course of 8 min (playback mode). Two magnetic tape stores with different recording and playback speeds are installed in the system for the storage of digital information.

Both the analog and the digital data are transmitted by means of a phase-modulated 2-Watt transmitter, whose carrier frequency is around 136 MHz.

The progress of the mode at predetermined times is controlled by a timer which is connected both with the control unit of the satellite and with a quartz-controlled digital clock which is accurate to better than 1×10^{-5}. Figure 1 shows a simplified block diagram of the system [1].

Digital Tract of the System

The procedures used for digital data transmission have developed out of PCM [pulse-code modulation] technology, as it is used in ground-based communication systems. The advantages of these procedures are principally in the simple, direct data processing by means of a computer, the improvement of the transmission accuracy, and the simple practicability of data reduction and coding. Moreover, digital systems can be very flexibly designed with respect to the number of measurement channels, which should include the possibility of better exploitation of the transmission channels by appropriate data packing.

Purpose and Operating Mechanism

The digital tract of the system has the purpose of acquiring digital and analog information from the most varied sources and filing it in recognizable form in a time-ordered serial binary stream. The serial digital information stream must be prepared for the modulation of a transmitter and for digital data storage on a magnetic tape.

The above-mentioned procedures of PCM technology are the basis for the operating mechanism. The information channels fed to the telemetry system are cyclically sampled in time division multiplex, and the data value present at the time of the sampling is converted into a digital word equivalent to its value.

At the same rate as the interrogation of the information channels, the digital words produced are formed into a serial binary structure, in which all the information to be transmitted is arranged into a known time sequence.

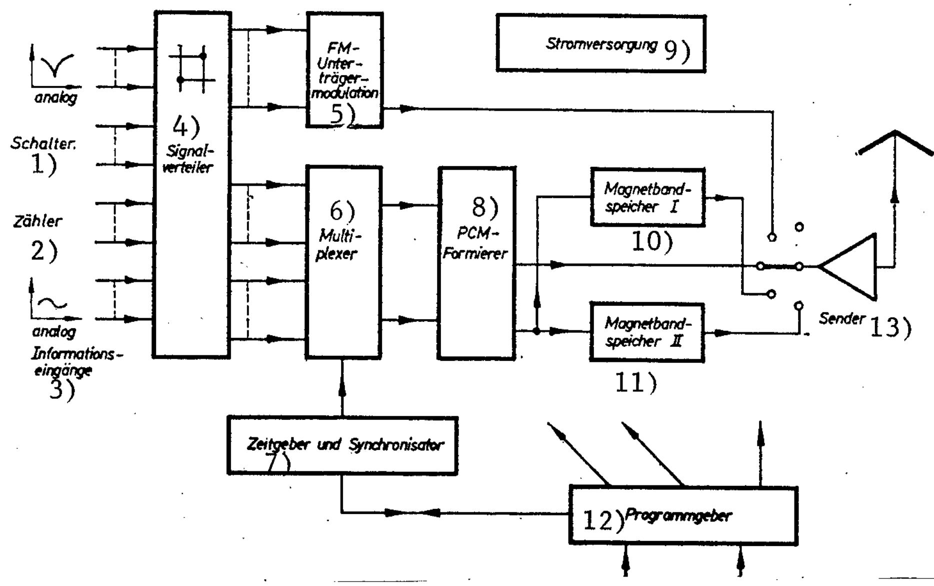

Figure 1. Simplified block diagram of the telemetry system.
Key:

1. Switch
2. Counter
3. Data input
4. Signal mixer
5. FM sub-carrier modulation
6. Multiplexer
7. Timing element and synchronizer
8. PCM formation
9. Power supply
10. Magnetic tape store I
11. Magnetic tape store II
12. Timer
13. Transmitter

Each sampling cycle -- that is, each telemetry frame -- is marked by a constant, known bit sequence, which finally serves for synchronization between the system multiplexer and the data acquisition and mixing system on the receiving end. By means of such a synchronization, the individual items of information can be recovered from the serial data stream. In order to avoid synchronization errors, the structure and length of the synchronous bit sequence are chosen in such a way that they can be distinguished with a high degree of probability from data bit sequences of equal length.

Two types of input channels in the system, which are mixed by a digital and an analog multiplexer, make it possible to process the available data in digital as well as in analog form. The words for the digital data are constructed by parallel input -- this means that as many digital channels are interrogated by the multiplexer as there are bits needed to construct a word. In contrast, the digitalization of the analog data requires a series of intermediate steps.

Basically, a digital word is formed every time the signal from an analog channel is mixed. The steps in the formation of a digital word from analog data are briefly shown in the following paragraphs. During a fraction of the channel

signal mixing, the current value of the test voltage of a sample-and-hold circuit is received and stored in the hold phase until the quantization of the analog voltage into a digital word in a connected analog-to-digital converter (ADC) is completed. The word is put out from the ADC in parallel form, so that further processing can be performed just as for data that were originally in digital form.

In a cumulative-OR circuit, the digital words formed in various ways are collected and written word by word in the intermediate storage of a parallel-series converter (PSC). The series is converted by stepwise interrogation of the storage units in time with the bit sequence frequency.

For security, a parity bit is attached to each data word; it is formed in a parity generator attached to one of the PSC.

The serial data sequence put out by the PSC has an NRZ-H structure -- that is, the logical H is expressed as a positive voltage level and the logical L as a zero voltage level. In comparison with other well-known structures, this signal structure requires the smallest transmission bandwidth and is therefore used for the modulation of the system transmitter.

The disadvantages of NRZ-H that can result from possibly long H- or L-sequences and can lead to difficulties in maintaining the zero level in the regulators on the receiving end, can be largely excluded by compensation. This structure is used in the receiving units developed in the Electronics Institute of the GDR Academy of Sciences. NRZ-H is not appropriate for digital data storage on magnetic tape. Here the recording procedure requires signal structures that mark each bit with an appropriate change of signal. For this purpose, a bit encoder has been installed to change the NRZ-H structure into a biphase-M structure. The characteristic of the biphase-M is that L is marked by a signal change at the ends of a bit, and H by an additional signal change in the middle of the bit.

In contrast to direct transmission, data storage takes place at lower bit rates, which are adapted to the current storage mode (rotating or diurnal mode) by external control.

Figure 2 shows the simplified block diagram of the digital tract, including a subcommutator whose purpose and method of operation will be described later.

Structure of the Telemetry Frame

The digital system is designed for a frame length of 64 words with 10 bits per word, so that the telemetry frame contains 640 bits -- a frame length that is also proposed in the international standard for telemetry systems with multiple applications.

The plan of the system is so designed that the inner structure of the basic frame can be changed by internal circuit changes or by external commands, making a flexible application possible. Table 1 shows the basic form of the frame structure as designed.

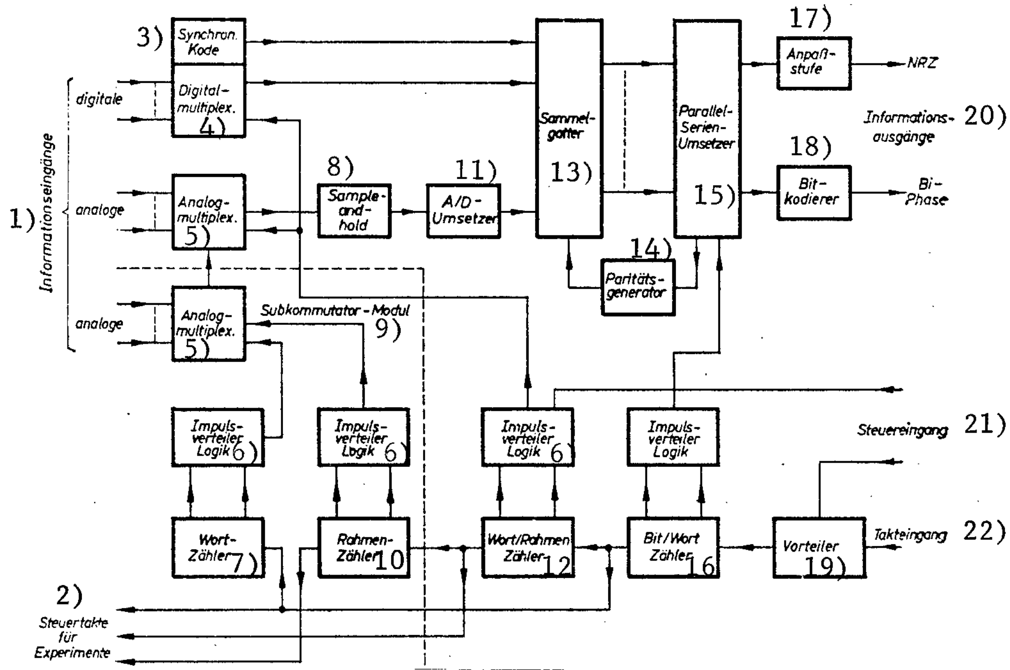

Figure 2. Block diagram of the digital tract with subcommutator.
Key:

1. Data input	12. Word/frame counter
2. Command sequence for experiments	13. Cumulative switching circuit
3. Synchronous code	14. Parity generator
4. Digital multiplexer	15. Parallel series converter
5. Analog multiplexer	16. Bit/word counter
6. Pulse distributor logic	17. Matching stage
7. Word counter	18. Bit encoder
8. Sample-and-hold	19. Distributor
9. Subcommutator module	20. Data output
10. Frame counter	21. Command input
11. A/D converter	22. Timing input

Beginning with this form, the number of words containing digital data can be changed from 16 to 8 by internal changes in the circuits. Similarly, the number of analog words can be changed from 48 to 56. Completely different arrangements are also conceivable, however, so that here there is already a certain possibility for variation in accordance with the need for information channels.

There is also the possibility of mixing the signal of an analog channel A_s, which is independent of the other channels, instead of the currently available channels, by means of an external command. This channel is especially useful for the connection of additional analog channels which are associated with a subcommutator module, but it can also be used as an independent channel for

fast data interrogation. Depending on the construction of the timing mode for the control command, the basic structure or the structures introduced through channel A_s can thus be successively coordinated in the data stream of the telemetry signal. By means of a subcommutation and the associated multiple time subdivision, structures that exceed the cycle of a telemetry frame are also possible.

Table 1. Frame Structure

Words in Frame	Nature of Input Data	Number of Input Channels
0-2	frame synchronization	--
3-7	digital switch information	45
8-15	digital counter information	72
16-63	analog information	48

For the purpose of a flexible system design, the subcommutator is planned as an external module and constructed according to current requirements. A module that was designed for a particular application and the facilities it provides are the subject of the following illustrations.

In this particular case, data from six different experiments are to be transmitted and stored. The data are brought in through 20 analog and 16 digital data channels. Since all the digital data do not have to satisfy any special requirements, they are assembled in an 8-word data block together with the synchronization and timing words and some system data, and coordinated in each basic frame of the main commutator.

The problem lies in the data processing of the 20 analog channels. The data from 16 channels are functions of time with cut-off frequencies f_g, which, according to the usual sampling theorem ($f_s \geqq 2 f_g$), require sampling frequencies of $f_s > 28$ Hz for complete recovery of the information. Since the sampling rate in the "direct digital mode" is 17.07 Hz, satisfactory transmission through the main commutator is possible by means of multiple mixing.

On the other hand, the sampling rate in the "storage" mode, which is 2.1 Hz, is not sufficient to record the data completely. In this case, the time packing of information groups by means of subcommutation permits multiple mixing which corresponds to the required sampling rate, and thus complete transfer of the data, although in time-interrupted form. In this procedure, at any given time 4 of the 16 data channels are collected into a channel group, in which the individual channels are mixed in succession. With 56 possible samplings per frame, there are thus 14 mixings for each individual channel, corresponding to a sampling frequency of $f_s = 30$ Hz.

The channel groups are connected in a multiframe sequence determined by the subcommutator; it can be adapted to the specifications of the data signals. In the present case, a multiframe sequence of 16 basic frames proved to be useful. Each channel group entered the telemetry signal for four successive basic cycles. Figure 3 shows the actual subcommutator with its control logic.

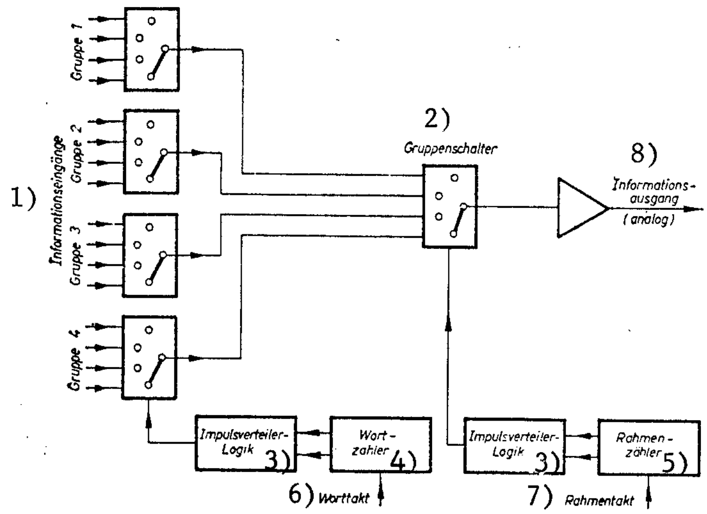

Figure 3. Principle of the subcommutator.
Key:

1. Data input
2. Group switch
3. Pulse distributor logic
4. Word counter
5. Frame counter
6. Word rate
7. Frame rate
8. Data output (analog)

This subcommutation method offers many variations to record data with very diverse time functions. It permits extremely flexible system planning, without requiring changes in the basic apparatus.

Function Groups in the Actual System

Some important function groups and the way in which they are carried out will be described in this section. In functional sequence, the multiplexer system, the analog-to-digital conversion, the parallel-series conversion, the bit coding and the timing control will be described.

Multiplexer System

As has already been stated, digital as well as analog data must be processed, so that multiplexers for each kind of data are required.

The digital version consists of a number of input gating circuits, which for each nine data channels act as an AND-gating combination in a power-conserving RDT logic system (see Figure 4). In order to transfer the data from the individual gating circuits, a temporally offset clear signal limited to a word time is fed to them through a transistor switch. The data are given by the input gate to an intermediate gating circuit (logical OR), whose purpose is the stepwise combination of several similar input gating circuits. The digital input gating circuits intended for the input of switching information do not clearly stand

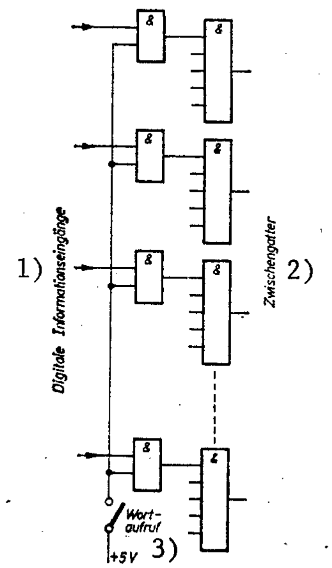

Figure 4. Input gating circuit of the digital multiplexer.
Key:

1. Digital data input
2. Intermediate gating circuit
3. Word call

out in the switching schematic shown in Figure 4. The advantages of uncomplicated control and the easy programmability of the digital gating circuit militate in favor of carrying out the combination of synchronous words by means of the multiplexer also.

The analog version of the multiplexer is much more difficult. Together with the analog-to-digital converter, it essentially determines the reliability and accuracy of the system. The time-multiplexed signal mixing of the analog data must be carried out in a voltage range from a few millivolts up to 6V, without perturbations from environmental factors and with an accuracy of better than ± 0.4%. Such stipulations require switches that approach the ideal mechanical switch, with its almost zero forward resistance and its very high back resistance. Favorable properties in this respect are shown by MOS-field effect transistors, whose further advantages lie in low-power guidance and good temperature constancy. This type of transistor , which is also used in the digital part, is applied in the form of a switching matrix in the analog multiplexer.

For each input channel, a time-multiplex current path is connected in the switching matrix to an operations amplifier, which makes an impedance change for matching to the following stages, and a level correction.

The entire multiplexer system is controlled by a word/frame counter and pulse distribution matrices, which take care of the logical coordination of the control pulses for the switches.

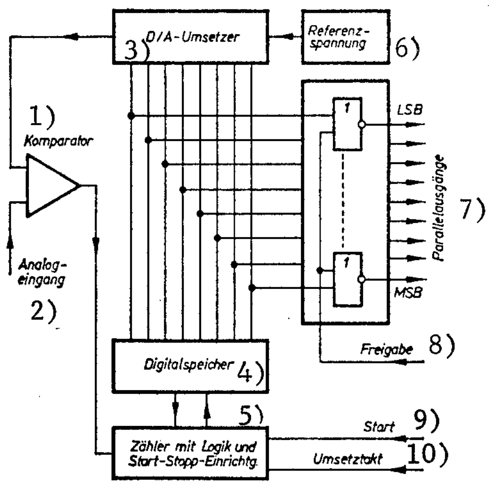

Figure 5. Simplified block diagram of the 9-bit analog-to-digital converter.
Key:

1. Comparator
2. Analog input
3. D/A converter
4. Digital store
5. Counter with logic and start-stop unit
6. Reference voltage
7. Parallel output
8. Clear
9. Start
10. Conversion timing

Details concerning the construction of the switching matrix and its control are described in [2].

Analog-to-Digital Converter with Sample-and-Hold Circuit

In order to arrange for an uninterrupted conversion process, the information voltage from the mixed channels is first fed to a sample-and-hold circuit, whose time constants are dimensioned in such a way that they are equally effective for all adjustable bit rates (conversion mode) without switching.

The circuit is controlled by the central timing unit of the system. A time offset of 3 bits between the channel mixing and the sample phase safely prevents the falsification of the measurement voltage by closing of the channel switch.

The conversion and quantization of the analog voltage into a 9-bit digital word takes place during the hold phase in the connected analog-to-digital converter. The ADC works on the principle of successive approximations to the input value, a procedure that allows a high degree of accuracy for medium to fast measurement speeds. The most important functional units of the ADC are shown in Figure 5.

With a control pulse that is identical with the sample pulse of the sample-and-hold circuit, the ADC is put into a stand-by condition. This means that the result of the previous conversion process is erased, and the counter unit is set

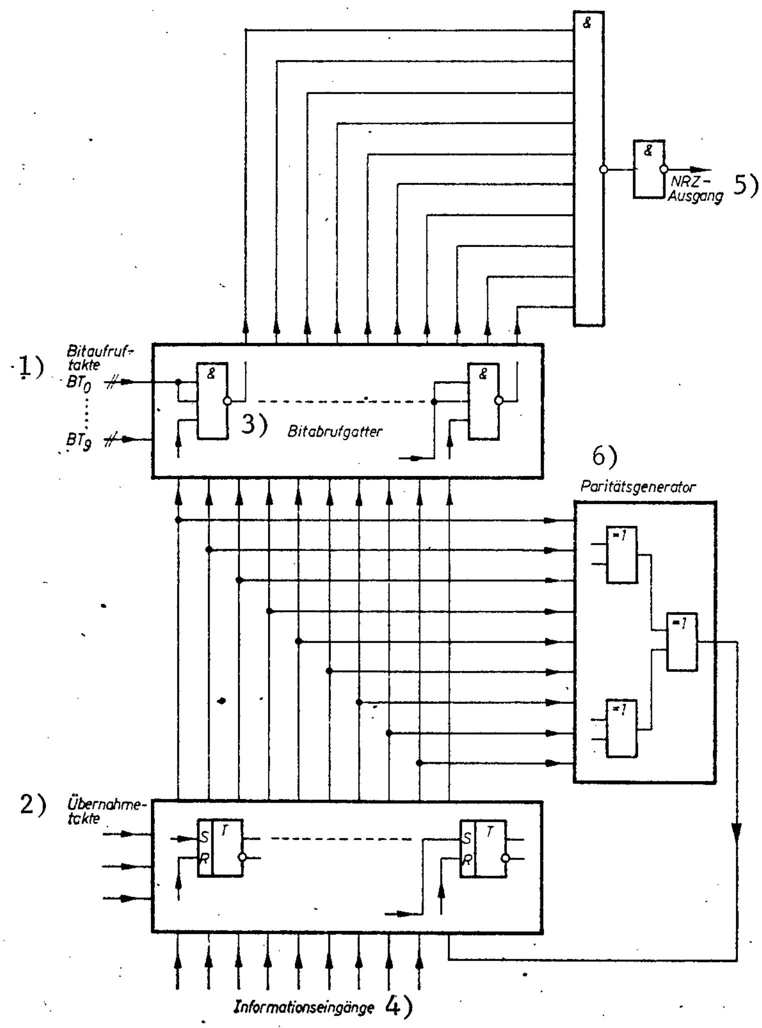

Figure 6. Simplified block diagram of the parallel-series converter with parity generator. Key:

1. Bit call-in timing
2. Transfer timing
3. Bit recall gating circuit
4. Data input
5. NRZ output
6. Parity generator

to its output position. With the trailing edge of the control pulse, which also determines the beginning of the hold phase, a gating circuit is opened to allow the conversion process to proceed in time with the clock frequency. The gate is automatically closed after the passing of the ninth conversion time, and thus the conversion is terminated.

The transformation process itself is completed by stepwise comparison of the input voltage U_E with a two-step reference voltage, which is fed in from a controlled quantization network. Beginning with $U_{Ref/2}$ (MSB), the reference

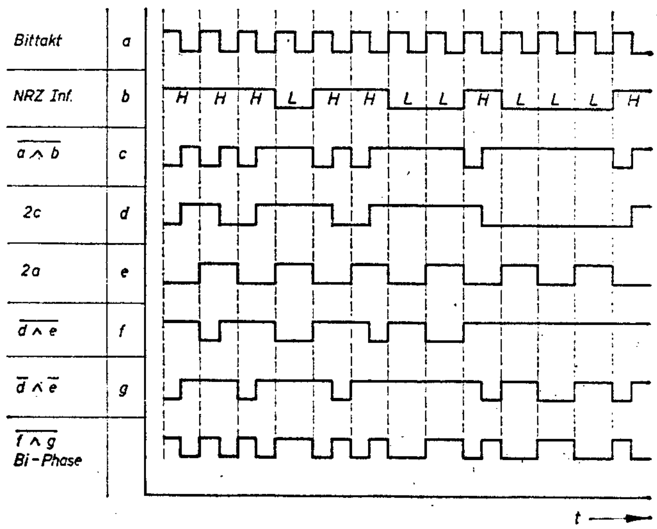

Figure 7. Pulse diagram for the production of the bi-phase structure.

voltage is brought near the input voltage in 511 possible binary steps. A comparator determines the present situation $U_E \gtrless U_{Ref}$ and passes the result to the control logic, which files it for recording in the cell of the digital store that corresponds to the approximation step.

At the end of the conversion procedure, the result of the quantization is binary encoded, parallel to the output of the digital store. A controlled output gating circuit prevents the overwriting of digital information in the collection gate. The output gating circuit also acts as a programmable word encoder for the analog data.

Parallel-Series Converter (PSC) With Parity Generator

For parallel-series conversion, an intermediate storage procedure is used, in which the information recorded in the storage unit remains there for the duration of the conversion. This procedure has the advantage that relatively fast conversion times can be achieved with power-saving circuit elements. Figure 6 shows the block diagram of the converter. The gating of the PSC with the digital multiplexer and the ADC is performed by nine NOR-gates, whose output carries the information bits of the currently mixed word.

Transfer into the intermediate storage unit takes place in such a way that bit B_0 is already read in one bit time before the conversion, and bits B_1 to B_8 at the beginning of the conversion of the word. This arrangement prevents perturbations that could result from the change of data in position B_0 during the conversion. The conversion of the currently stored word into a serial bit sequence is accomplished by stepwise interrogation of the storage cells through the bit recall gating circuit.

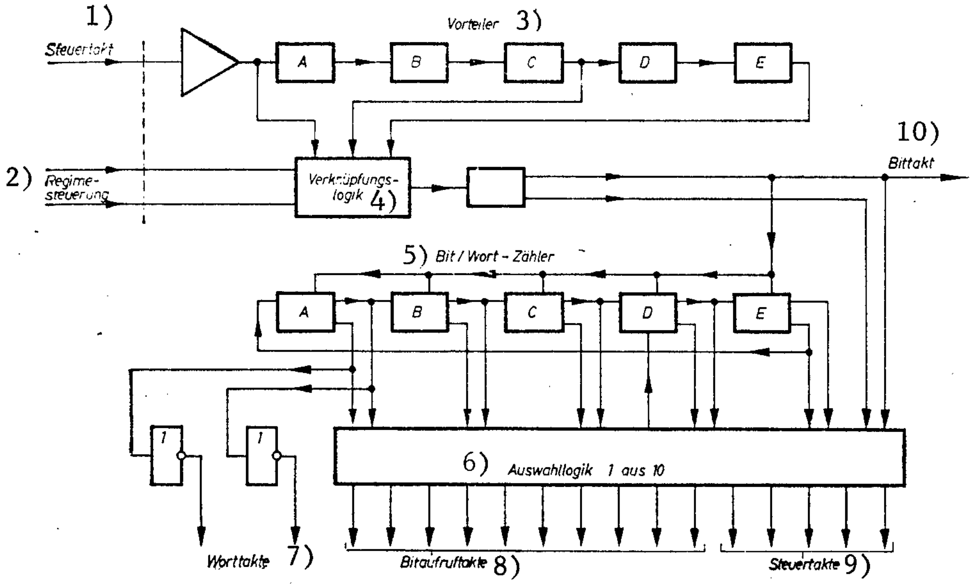

Figure 8. Simplified block circuit diagram of the converter control.
Key:

1. Control timing
2. Mode control
3. Distributor
4. Gating logic
5. Bit/word counter
6. Sampling logic (1 of 10)
7. Word timing
8. Bit call-in timing
9. Control timing
10. Bit timing

A 9-bit exclusive OR, which is parallel to the call-in gating circuits at the output from the storage unit, forms the antivalence over the data bits of the word during the conversion process. The result is recorded in the last cell of the storage unit with a third transfer timing, and thus placed behind every data word.

Bit Encoding

It has already been mentioned that the NRZ signal structure produced in the PSC is not appropriate for digital data storage, so that conversion of the signal structure into another format is required. Out of many possible formats, the bi-phase M proved to be the most appropriate for the storage procedure used in the system.

In principle, bi-phase M is produced as an equivalence from the doubly expanded bit timing and the conjunctive gating of the bit timing with the NRZ signal, which are also doubly expanded.

The pulse diagram in Figure 7 shows the production of the bi-phase format from an assumed NRZ signal.

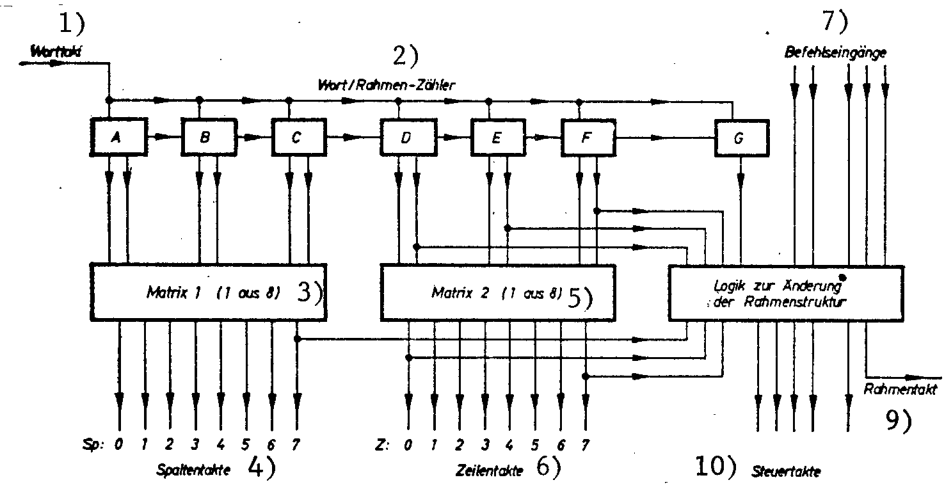

Figure 9. Simplified block circuit diagram of the multiplexer control.
Key:

1. Word timing
2. Word/frame counter
3. Matrix 1 (1 of 8)
4. Column timing
5. Matrix 2 (1 of 8)
6. Line timing
7. Command input
8. Logic for changing the frame structure
9. Frame timing
10. Control timing

Timing Provision and Control Circuits

The timing provision of a time-multiplex telemetry system is generally taken care of by a control timing, which is divided by divider groups into frequencies that determine the longest time cycle in the system.

The digital tract is controlled by a system pulse generator with quartz accuracy. The first division steps in the apparatus produce the bit timing. Its frequency, and thus the conversion rate of the system, depend on the division ratio of the preliminary divider, which can be changed for mode switching by means of external commands through a gating logic. Beginning with the bit timing, all the rates that are repeated in the word cycle are produced in the following 10:1 division stages, the bit/word counter, the word timing and one of the logic circuits associated with the counter. These are all the timings used to control the conversion process in the ADC and the PSC. Figure 8 shows this portion of the control in a block circuit diagram.

The length of the telemetry frame, which in the system is set at 64 words, is produced with a 6-bit binary counter. The counter stages A, B, C and D,E,F each control a 1-of-8 matrix, from which the column and line pulses for the control of the switching matrix for the multiplexer and also the frame rate are derived. A logical circuit that changes the structure of the telemetry frame upon external command is directly connected with the word/frame counter and the matrices 1 and 2. With the addition of counter stage 9, it is possible to alternate the operating procedure between two structures. Figure 9 shows the block circuit of the multiplexer control.

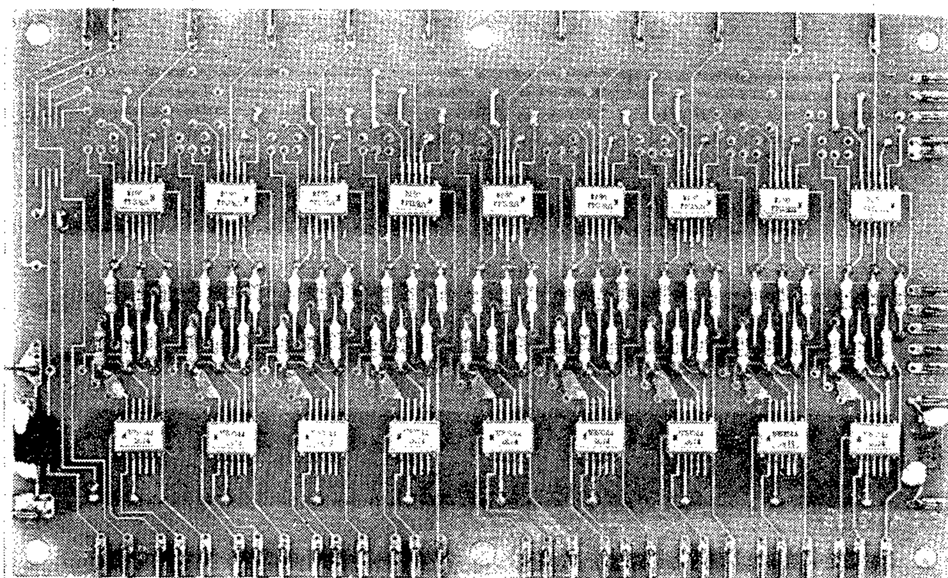

Figure 10. Circuit board for the apparatus.

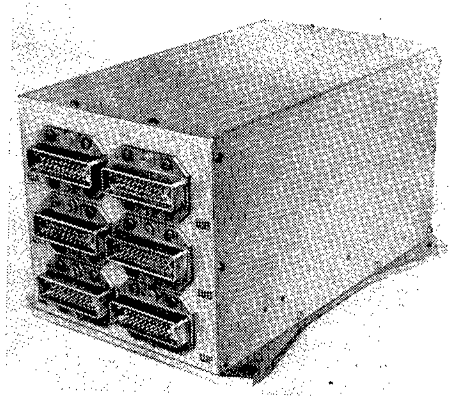

Figure 11. View of the apparatus.

Moreover, word and frame timings for the control of the subcommutator are derived from the above-named control circuits. The counter circuits of the subcommutator in turn produce the cycles for the frame overflows.

Mechanical and Electrical Construction

Decisive construction criteria for the production of instruments and instrument systems to be used on spacecraft are low weight and small volume, with a high degree of stability and the lowest possible power consumption -- criteria which in practice must necessarily lead to compromises, because of the diametrically opposed requirements.

The digital tract is constructed in a compact design that abandons the otherwise usual circuit board connectors as they appear in different variations in ground-based instruments. Figure 10 shows a circuit board for the instrument, and Figure 11 the instrument as a whole.

In order to keep down the power consumption, TTL low-power circuits are mainly used in the electronic circuits.

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CSO: 2302

EAST GERMANY

TELEMETRY SYSTEM FOR METEOROLOGICAL ROCKET M 100 DISCUSSED

East Berlin RADIO FERNSEHEN ELEKTRONIK in German No 3, Feb 77 pp 73-75

[Article by A. Andersson, R. Goersch and G. Zimmermann of the Electronics Institute of the GDR Academy of Sciences: "Telemetry System for Meteorological Rocket M 100"]

[Text] The telemetry system for the M 100 meteorological rocket consists of two complexes, the on-board telemetry in the rocket and the ground receiving station for the recording of the signal. In the period from 1973 to 1975, two different types of telemetry were successfully used on M 100 rockets for data transmission: frequency-division multiplex and time-division multiplex procedures. Because of the receiver design chosen, no additional antenna is needed, so that specialized applications in other areas are also conceivable for this equipment.

On-Board Telemetry

The purpose of the on-board telemetry equipment is to transmit signals from the on-board sensors to earth during the flight of the rocket. A transmitter sends the information either by means of six IRIG standard subcarriers (frequency-division multiplex system), or by a 16-channel commutator and following VCO (time-division multiplex system). The transmission frequency is 136 MHz, the radiated power about 0.5 Watt.

On-Board Telemetry with IRIG Subcarriers (System MSP-1)

The block diagram (Figure 1) should elucidate the principle of transmission according to the frequency-division multiplex procedure.

The data from the experiments on board the rocket are conducted to the input of the IRIG channels as measurement voltages of 0 to +6 V. These IRIG subcarrier-modulators are free-running multivibrators, which provide a proportional voltage-to-frequency conversion. The frequency ranges of the subcarrier channels are specified according to the IRIG standard (Table 1).

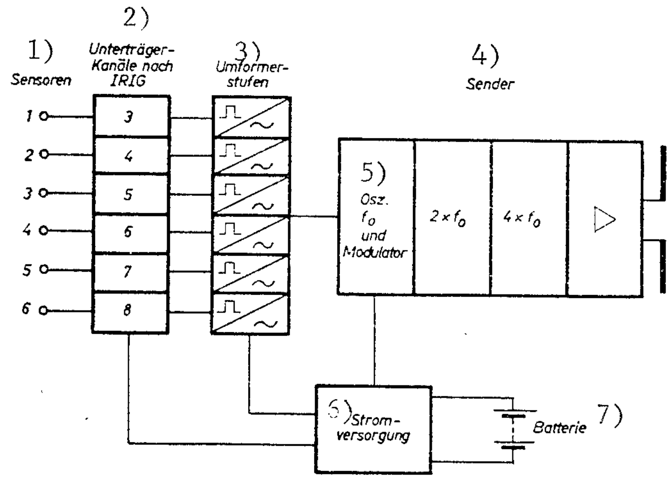

Figure 1. Block diagram of the MSP-1.

Key:

1. Sensors
2. Subcarrier channels to the IRIG
3. Conversion stages
4. Transmitter
5. Oscillator f_o and modulator
6. Power supply
7. Battery

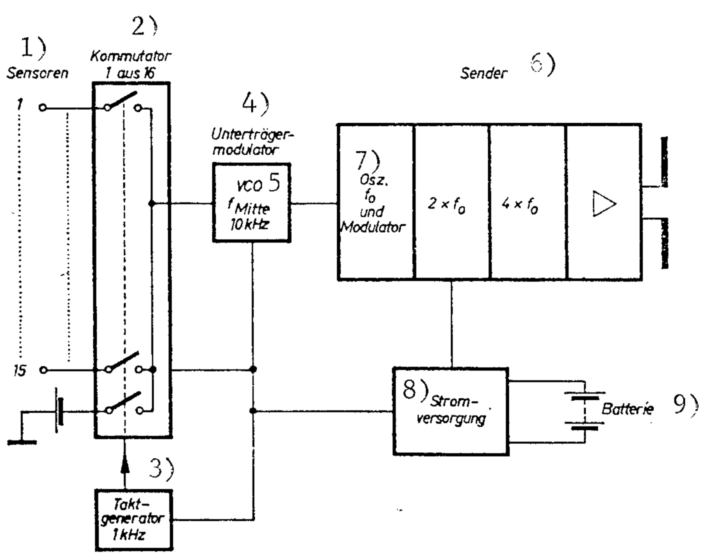

Figure 2. Block diagram of the MSP-2.

Key:

1. Sensors
2. Commutator (1 of 16)
3. Pulse generator (1 kHz)
4. Subcarrier-modulator
5. VCO (f_{mean} = 10 kHz)
6. Transmitter
7. Oscillator f_o and modulator
8. Power supply
9. Battery

Table 1. Frequency Ranges of the Subcarriers According to the IRIG Standard

IRIG	f_u (for $U_e = 0$ V)	f_m ($U_e = 3$ V)	f_o ($U_e = 6$ V)
3	675	730	785
4	888	960	1032
5	1202	1300	1398
6	1572	1700	1828
7	2127	2300	2473
8	2775	3000	3225

The circuits chosen have a high degree of linearity, so as to ensure an exact conversion of the measured voltage into the corresponding output frequency. With the voltage controlled oscillator (VCO) used, the linearity is $< 0.2\%$. The frequency variation of the VCO's in the temperature range from 1 to +40 °C is $< 1\%$, and the input resistance is about 380 kΩ. The transformed measurement voltage for the sensors reaches the present conversion stage as a square wave. There it is converted nearly into a sine wave, in order to keep the harmonic content of the individual channels as small as possible. In addition, the corresponding amplitude of each oscillator is here adjusted for the subsequent modulation in the telemetry transmitter.

On-Board Telemetry With 16-Channel Commutator (System MSP-2)

Figure 2 shows the block diagram of the MSP-2. The measured data arrive at the commutator input positions 1 through 15. The commutator essentially consists of 16 double-MOS field-effect transistors, which act as an input switch, the pulse generator and the control logic for the MOS switch. The pulse generator delivers a frequency of 1 kHz for the interrogation of the 16 switches. That corresponds to an interrogation time of 1 ms per switch. Thus a cycle lasts for 16 ms. In this way a data set with 62.5 points per second can be transmitted from each channel. By shunting the commutator channels, the number of measured points per second can be considerably increased (see Figure 3).

Of course, a compromise must be made between the number of measurement channels (experiments) and the frequency to be transmitted. For a single experiment, the solution shown in Table 2 was applied.

Table 2. Number of Measurement Channels and Transmission Frequency for One Experiment

Sensor	Number of Commutator Channels	Points per Second
1	4	250
2	4	250
3	1	62.5
4	3	187.5
5	3	187.5
Σ 5	15	937.5

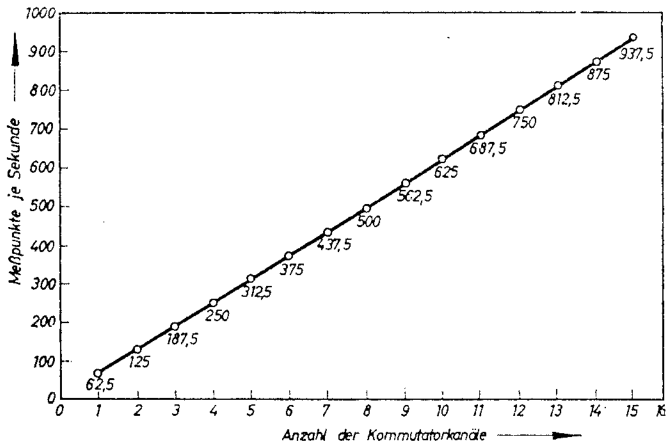

Figure 3. Number of measured points per second (ordinate) as a function of the shunted commutator channels (abscissa).

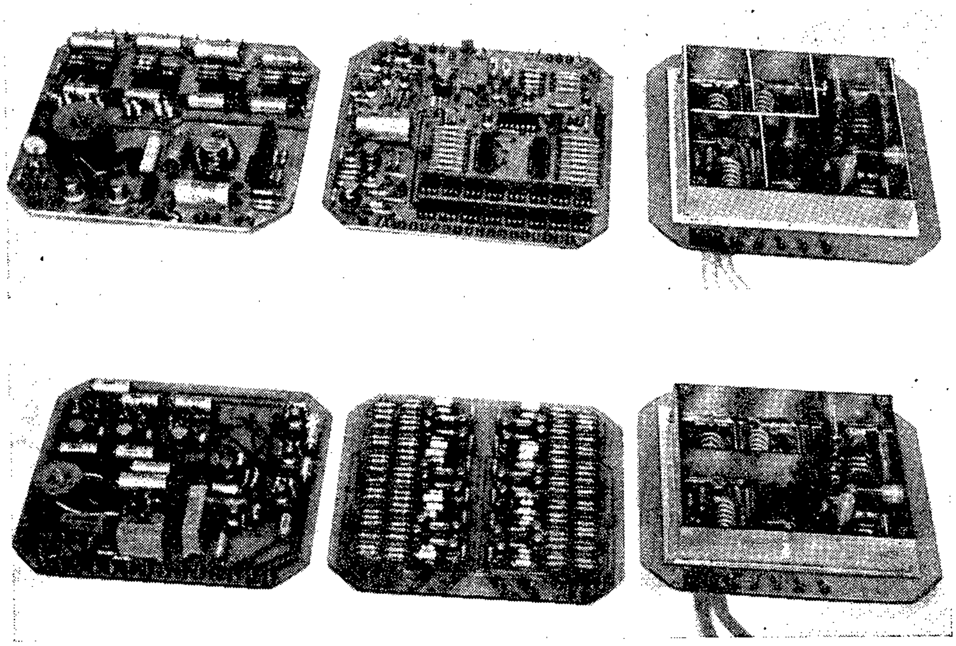

Figure 4. Pictures of the individual components. Below: MSP-1 -- power supply, VCO subcarrier board, transmitter. Above: MSP-2 -- power supply, multiplexer, transmitter.

One commutator channel is required for the transmission of a synchronous pulse of - 0.5 V. This voltage pulse is needed for synchronization in the ground station. The negative voltage of - 0.5 V was chosen in order not to impinge on the region of possible measurement voltages (0 to +6 V). The currently connected measurement voltage is finally converted into a frequency in the following VCO. The mean frequency of the VCO is displaced from 10 kHz to about 2.5 kHz by the measured voltages fed in.

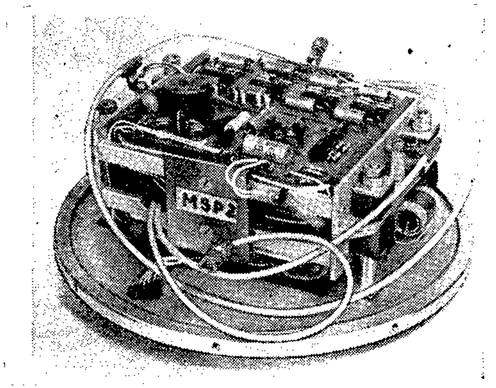

Figure 5. MSP-2 on its base plate.

At the output from the VCO there is an operational amplifier, with which the stroke needed for the modulation of the transmitter is used.

Advantages and Disadvantages of the Two Transmission Procedures

In frequency-division multiplex transmission, the collected data arrive at the ground station as a frequency-modulated low-frequency mixture. There it can be stored on a magnetic tape and/or demodulated and displayed by means of a multi-channel recorder. The advantage is that there is no loss of information, owing to the simultaneous transmission of all channels. The disadvantage is the great expenditure of work and time that is required to balance all the subcarrier-modulators of the on-board transmitter. One must also pay attention to the fact that perturbations in the higher-frequency channels can occur as a result of harmonics of the lower IRIG channels.

This possible source of error cannot occur in the time-division multiplex procedure. Here only one VCO is frequency-modulated. The time and work spent in balancing are accordingly much less. However, because of the sequential interrogation of the experiments, a certain loss of information occurs, depending on the interrogation frequency. The interrogation frequency, in turn, is determined by the dynamical response of the subcarrier-modulator and the magnetic tape recorder. The pulse generator frequency of the commutator can also not be arbitrarily increased.

The transmission of a reference voltage (synchronous pulse) operates favorably in the case of a temperature drift of the subcarrier frequency on board. With this procedure it is possible to correct the telemetry data in the ground station within certain limits, since the amplitude of the reference voltage is transmitted at the same time.

The Telemetry System and Its Components

The on-board telemetry system consists of three principal parts, each of which is contained on one circuit board: the power supply, the modulator, and the transmitter.

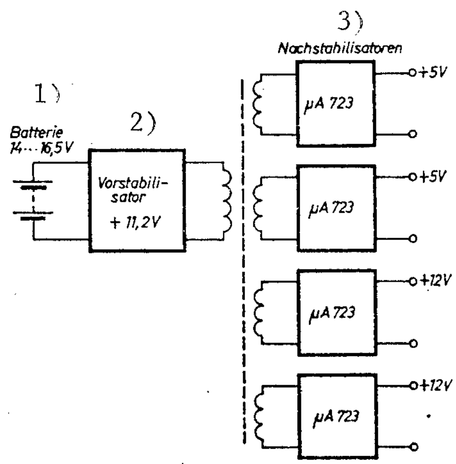

Figure 6. Block diagram of the power supply.
Key:

1. Battery 14-16.5 V
2. Prestabilizer + 11.2 V
3. Restabilizers

Power Supply

The purpose of the power supply is the regulate fluctuations in the battery voltage on board the rocket and to produce the required stabilized d.c. voltage for the transmitter and the modulation electronics. Moreover it effects a galvanic separation of the electronics from the battery (see Figure 6).

The battery voltage is first prestabilized to a value of 11.2 V in a prestabilizer. This is done by means of an in situ integrated voltage regulator with an external n-p-n power transistor. These two components are coupled to a normal regulating circuit. A coupled regulator is here deliberately avoided, since the battery power available onboard is sufficient for the entire flight-time of the rocket. This voltage runs a push-pull converter, which produces four secondary voltages. These are again stabilized by integrated voltage regulators. The on-board electronics is supplied with these voltages.

The development of the integrated precision voltage regulator MAA 723 and μA 723 reduces the circuit engineering expenditure on this component to a minimum.

Modulator

The modulator is that part of the telemetry system that transforms the measurement voltages into an audio-frequency mixture or a low-frequency signal. In the MSP-1 system, it is voltage-controlled oscillators, and in the MSP-2 system it is a multiplexer with following VCO.

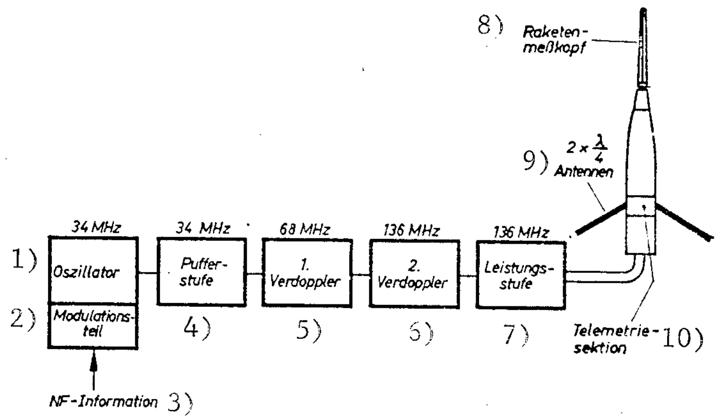

Figure 7. Block diagram of the 136 MHz transmitter (MSP-1 and MSP-2).
Key:

1. Oscillator
2. Modulation element
3. Low-frequency information
4. Buffer stage
5. First frequency doubler
6. Second frequency doubler
7. Power stage
8. Rocket measuring head
9. Two quarter-wave antennas
10. Telemetry section

Transmitter

The transmitter is to transmit to the ground station the measurement voltages delivered by the experiment, which have been converted to a frequency in the subcarrier-modulators. The block diagram (Figure 7) shows its method of operation.

The transmitter is supplied with the prestabilized voltage of 11.2 V. In order to obtain high frequency stability, a quartz crystal is used in the oscillator to generate the oscillations. This is a special quartz crystal which must satisfy stringent requirements, since it must operate reliably under working conditions with a high linear acceleration. Further stabilization of the operating voltage of the oscillator is necessary for stable operation of this stage. Two capacitance diodes are used in the oscillator for the modulation of the transmitter. A buffer stage with π - filter output is connected behind the oscillator, to prevent retroaction from the following stages and to suppress harmonics.

After the buffer stage come two frequency-doubler circuits, which convert the oscillator frequency from 34 MHz to 68 MHz and from 68 MHz to the transmission frequency of 136 MHz. The power stage, which operates at the end of the basic circuit, produces a transmission power of about 0.5 W at 136 MHz. This frequency is fed to the antennas through a π- filter. At the output from the filter, the matching necessary for antenna coupling is produced, and the proportion of harmonics is reduced. The technical data of the transmitter are summarized in Table 3.

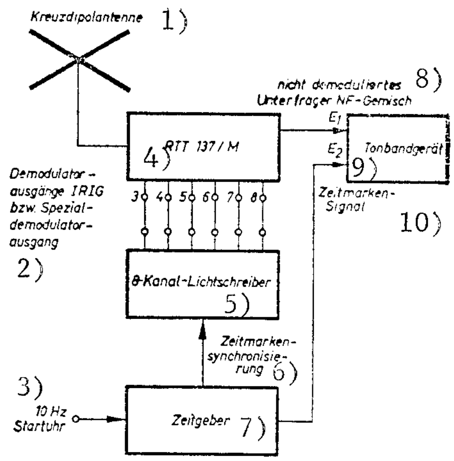

Figure 8. Block diagram of the ground receiving station.
Key:

1. Turnstile dipole antenna
2. IRIG or special demodulator output
3. 10 Hz start-up timer
4. RTT 137/M receiver
5. 8-channel display screen
6. Time-mark synchronization
7. Timing element
8. Undemodulated subcarrier low-frequency mixture
9. Tape recorder
10. Time-mark signal

Table 3. Technical Data for the Transmitter

Supply voltage U_e	+ 11.2 V
Current consumption I_e	109 mA
Power consumption P_e	1.22 W
Emitted high-frequency power P_{HF}	0.5 W
Efficiency P_{HF}/P_e	41 %
Carrier frequency f_c	136.00737 MHz
Temperature range	0 - 40 °C
Stability	$< 5 \times 10^{-5}$ in temperature range

Ground Receiving Station for MSP-1 and MSP-2

The M 100 ground receiving station allows the reception of rocket signals in the telemetry band from 135.5 to 138 MHz. With this receiving station, frequency-modulated signals can be received, demodulated and displayed in the IRIG 3-8 subcarriers as well as a special subcarrier.

The entire ground station is portable by design, and can be used on a support under field conditions.

The ground station consists of the following equipment: antenna; RTT 137/M receiver and IRIG 3-8 demodulators; timing unit; tape recorder; 8-channel display screen.

For small input field intensities, a much better signal-to-noise ratio in the demodulated sugnal is obtained in comparison with a conventional receiver, by means of the special demodulation procedure used in the receiver (coherent demodulation with phase-lock circuit) and by means of the production of an optimum resultant signal from two input signals which are conducted by two halves of the antenna with orthogonal planes of polarization (turnstile dipole). In this way it is possible to be sure of receiving the signals from on board the M 100 rocket with a simple turnstile dipole antenna which is not followed up. The rocket signal passes through the antenna and the antenna amplifier to the receiver. At the output from the receiver, one has the subcarriers obtained by demodulation of the main carrier.

This subcarrier mixture or subcarrier is first recorded by means of a tape recorder and then, after demodulation by the subcarrier demodulators (IRIG 3-8) or in the special demodulator, displayed by means of the 8-channel display screen (in the MSP-2).

In order to preserve a measured value proportional to the altitude of the rocket, timing marks are recorded on the second track of the tape recorder, beginning with the take-off of the rocket. The fade-in of these timing marks is performed by the timing unit. It is controlled by the start-up timer with a 10-Hz signal, and delivers a frequency-modulated signal (IRIG-8) which is recorded parallel to the telemetry signal on the second channel of the tape recorder.

The time pulses of the start-up timer are simultaneously conducted to the synchronization input for time-marking of the 8-channel display screen.

Figure 8 shows the block diagram of the M 100 receiving station.

Through storage of the transmitted signals on a magnetic tape, it is possible to recall or duplicate the desired data as often as necessary. Finally, it should also be pointed out that a follow-up antenna is made unnecessary by the modern receiver design. Thus this equipment can also be installed on ships, if they have an M 100 launching installation.

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EAST GERMANY

ROBOTRON VEB DEVELOPS COMPUTER-AIDED MICROFILM SYSTEM

East Berlin DIE DEUTSCHE POST in German No 4, Apr 77 pp 119-120

[Text] Microfilm has the recognized advantages of faithful reproduction, large storage density, and space-saving storage. It has been tried and proven long ago. But today these advantages are no longer sufficient. An attractive solution particularly requires efficient storage and management of inventory and rapid location of the required information by means of an electronic computer technology. As a component of a comprehensive information system, microfilm moves closer to the area of electronic computer technology. Through the computer-microfilm coupling, it offers new possibilities for technical applications.

Within the planned further development of ESER (Uniform Electronic Data Processing System), the combine Robotron VEB has included in its production program devices belonging to computer-supported microfilm technology. Its long years of experience in the area of electronic computer technology are here utilized to solve the computer-microfilm coupling possibilities both by means of hardware, as well as by supporting systems. The following were the starting points for designing the computer-supported ROBOTRON microfilm technology:

- implementing the connection conditions and other requirements of the uniform system for electronic computer technology of the Socialist countries for coupling with the corresponding devices of the ESER series

- including and using already existing hardware for microfilm technology

- using a uniform recording medium, Mikroplan film 148 x 105 mm, such as is also used for the devices of the uniform microfilm system

- applying the modular principle for adapting a minimum of basic hardware to the various user conditions

- using system supports which already exist within ESER, taking into account necessary modifications and supplements.

The microfilm output device - MFA - and the automated microfiche reading device - ALG - are available as the first units of computer-supported microfilm technology. These units can, for example, be inserted into the already familiar microfilm technology from the combine Pentacon VEB Dresden, and they provide a meaningful expansion of this system. Figure 1 shows a simplified schematic diagram. To aid clarity, details and the inclusion of already existing devices such as developing and duplicating devices, have been omitted.

The ROBOTRON Microfilm Output Device - MFA - EC 7602

This device rapidly records and outputs directly on microfilm information which is stored in electronic computer systems. Its essential characteristics are the following:

- full system compatability with all ESER components
- immediate availability of the required system supports
- problem-free inclusion into existing microfilm equipment.

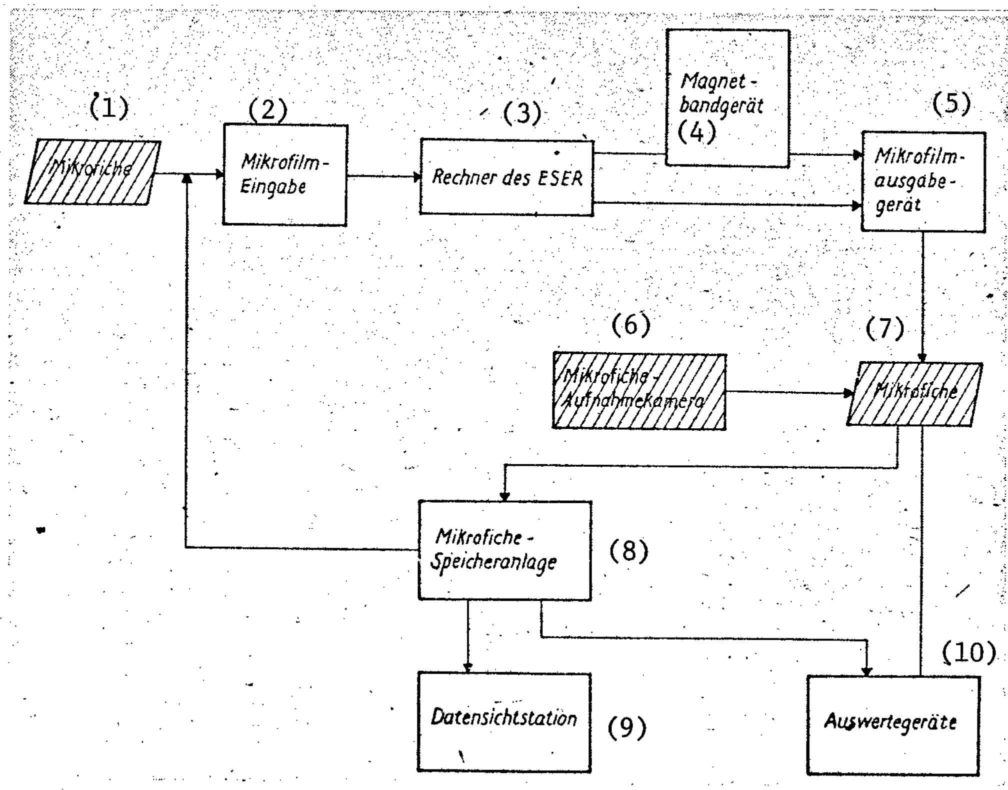
The usefulness of the MFA consists
- in its outpower, which is ten to fifteen times as great as that of mechanical rapid printers
- in the immediate production of the convenient data medium format A 6 without intermediate connection of an additional microfilming process
- in its simple, rapid, and economical production of an arbitrary number of copies by duplicating the original fiche
- in its expanded application as compared to mechanical rapid printers, by additional functions such as setting up form sheets and macrotext
- in its utilization for printing editions of already existing programs
- in satisfying varied user requirements by diverse equipment variants with a uniform basic design
- in its direct production of visually readable documents with the smallest filing requirement by recording on 16 mm roll film.

The microfilm output device ROBOTRON EC 7602 is produced in two variants. Model 1 has the standard ESER interface and is directly coupled for collaboration with every ESER central processor unit which works in the OS/ES [expansion unknown]. Model 1 works in on-line operation. Model 2 can be connected for collaboration with a magnetic tape unit. This model operates in off-line operation. All the necessary systems, of course, are available to couple Model 1 directly to an ESER central processing unit.

The ROBOTRON Microfiche Reading Unit - ALG -

This device serves to reproduce the microfiches as well as other sheet film, for example roll film, paste-ups, and jackets in the A 6 format. With the ALG, the user has the capability of rapidly locating his microfilmed and stored documents, his drawings, maps, graphic displays, printed material or patents in the 8-format including fiches from EDP microfilm output. Without manually touching the storage medium, it is

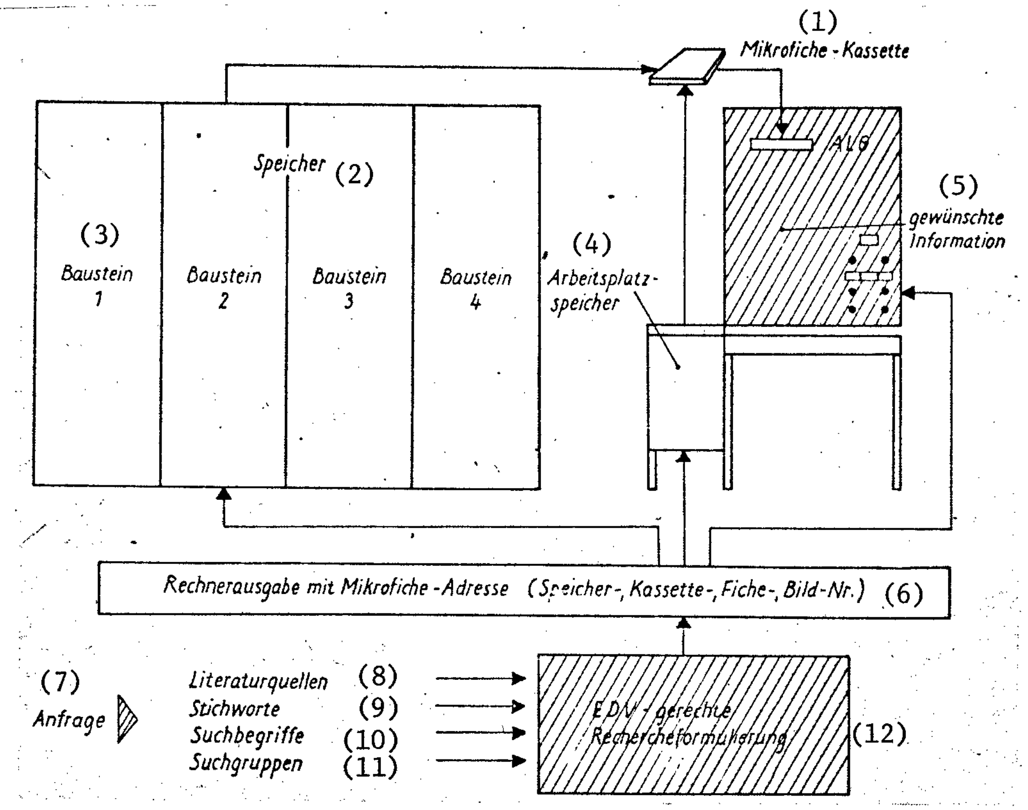
Figure 1: Simplified Diagram of Computer-Supported Robotron Microfilm Technology



Key:

1 Microfiche
2 Microfilm input
3 ESER computer
4 Magnetic tape unit
5 Microfilm output unit
6 Microfiche photograph camera
7 Microfiche
8 Microfiche storage system
9 Data viewing station
10 Evaluation devices

Figure 2: Execution of a Search with Computer Support



Key:

1 Microfiche cassette
2 Storage
3 Module
4 Work place storage
5 Desired information
6 Computer output with microfiche address (storage-, cassette-, fiche-number, picture-number)
7 Request
8 Literature sources
9 Reference words
10 Search concepts
11 Search groups
12 Search formulation adapted for EDP

reproduced at its original size on the 450 mm x 450 mm display screen. Either two A 4 equivalents are here displayed side by side or one A 3 equivalent. The most important operating means for the automated microfiche reading device are the fiche cassettes. Each of them contains 25 coded microfiche. They form a basic storage building block. Through appropriate identification, they have become an ideal organizational means. Preserved in a storage chest, they guarantee the rapid location of the desired information and serve to transport the fiches.

The essential advantages are the following:

- The projected image can also be viewed in two optional magnification stages: 21 times and 14.8 times.
- As supplementary components, a work location storage for max. 80 cassettes can be arranged directly beside the ALG; or at a distance from it, a larger storage unit can be set up, which is constructed of modules with a maximum capacity of 200 cassettes. If 25 fiches with 60 individual images are figured for each cassette (A 4 equivalents), the capability exists of storing in one cassette 1500 A 4 equivalents and, directly beside the ALG 80 times that much, i.e. 120,000 A 4 equivalents.
- If the storage capabilities of just two storage modules are considered, the 400 cassettes can accept 600,000 to 720,000 A 4 equivalents or at least 60,000 filmed drawings of a larger format. This capacity can still be expanded, and should be able to satisfy even extreme requirements.

Both the above-mentioned advantages of the microfilm output device ROBOTRON EC 7602 and the organization of microfilm technology by using cassettes contribute towards satisfying the desire for a system that will store, search, and reproduce microfiches. Through appropriate processing, they also contribute towards opening up new areas of application. The fiche address can here be determined by means of an arbitrary search system. Depending on the hardware level, a variously high degree of automation can be achieved here.

Simple information systems can be directly adapted to the structure of the cassette organization. Search concepts can here be directly applied to the cassettes or fiche (index field). For example, travel information, city information, information on traffic connections, information on communication exchanges, banking information, and catalogues can be constructed in this fashion.

For scientific-technical and other information systems with a complicated structure, there exists an independent search system. An address code serves to locate the associated fiche. Already existing information systems for science and technology, information systems in the health area, legal information systems, the administration of drawings, and the like are to be associated with this user group. In a third group, the public library group, the search is primarily implemented by the client for this equipment. Here, the address is translated into its memory-internal code

form. For example, collections of journals, collections of patents, standards collections, and collections of scientific reports are involved here. Using the second group as an example, Figure 2 shows a possible organizational form. By means of the automated microfiche reading device ALG, this organizational form makes it possible to effect considerable efficiency.

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EAST GERMANY

BRIEFS

NEW TYPE OF THYRISTOR--Thermosenstor is the designation for a new type of thyristor in which the junction temperature acts as the input quantity for connection. It is a vertical plane component with specified doping and specified dimensions, to guarantee a secure connection with a high degree of reproducibility at a predetermined temperature. The connection temperature, which, for example, can be around 70 $^{\circ}C \pm 5$ $^{\circ}C$, can be shifted upwards by means of a resistor between the gating circuit and the cathode. This property also permits remote control of the connection temperature by insertion of a variable resistor. The connection is brought about by an increase in the leakage current through the principal junction. For this purpose, the specific resistance of the p-n junction must be increased by deep extrinsic doping with gold or copper in the principal junction. The thermosenstor can be operated with a single dry cell. [Text] [East Berlin RADIO FERNSEHEN ELEKTRONIK in German No 3, Feb 77 p 70] 8429

MICROWAVE TRANSISTOR DEVELOPMENTS--Through the application of new techniques, it has been possible to develop a bipolar microwave transistor in a metal-ceramic jacket with a noise factor of only 2.7 dB at 4 GHz. The corresponding amplification is 9 dB. The decisive steps in the process of producing this microwave transistor are ion implantation, local oxidation, and a completely new type of self-alignment of the mask. [Text] [East Berlin RADIO FERNSEHEN ELEKTRONIK in German No 3, Feb 77 p 70] 8429

MINIATURE LASER--A miniature laser the size of a grain of dust is composed of neodymium pentaphosphate. The neodymium ions that control the laser operation are set in pentaphosphate crystals with especial regularity and a high degree of concentration. Thus such crystals exhibit an optical amplification 10 to 100 times greater than for other materials. In this way pentaphosphate lasers can be made much smaller. They are thus of interest for thin fiberglass circuits in optical communications equipment. [Text] [East Berlin RADIO FERNSEHEN ELEKTRONIK in German No 3, Feb 77 p 70] 8429

PICTURE ENGRAVING SYSTEM--Picture engraving is the name of a system for the production of pictures on identification cards; it works on the principle of photography and photoengraving. The picture to be taken is secured with a vidicon camera, and then transferred to the card by means of electronic scanning.

Since the image becomes an inseparable part of the card, it cannot later be altered or counterfeited. The system is also suitable for the transfer of dark colors to the card. It works with 16 tone values, and can be extended to 32 tone values. The video signal produced by the camera is digitized for plotting on the card; each picture element requires 4 bits. Since the engraving device prints column-by-column on the card, a storage buffer is necessary to provide compatibility with the line-by-line method of production of the picture. [Text] [East Berlin RADIO FERNSEHEN ELEKTRONIK in German No 3, Feb 77 p 70] 8429

CSO: 2302

SATELLITE TRACKING STATION TO BE COMPLETED

Budapest MAGYAR NEMZET in Hungarian 10 Apr 77 p 3

[Article by Zoltan Gyulai: "Intersputnik - The Terrestrial Satellite Communication Station in Hungary Will Be Completed by the End of the Year"]

[Text] "In compliance with the provisions of a decree promulgated by the government of the People's Republic of Hungary, the Hungarian Postal Service will set up an Intersputnik space communication station in Taliandorogd during 1975-1977. The station enables long-distance continental and intercontinental exchange of television and radio programs, and telephone communication with the member countries of the Intersputnik system. The ground station will be built with Soviet technical assistance. With the festive deployment of the cornerstone, we declare the construction in progress."

The above is the text of the inaugural document signed on 17 May 1976 in Taliandorogd by Dezso Horn, deputy minister of transportation and postal affairs, general director of the Hungarian Postal Service, and Yuri Ivanovich Krupin, general director of the Intersputnik International Space Communication Organization.

Why Taliandorogd, of All Places?

The cornerstone was deployed almost exactly one year ago, with the inaugural document embedded in it; however, the history of the Hungarian ground station of the Intersputnik organization is longer than that. Bulgaria, Czechoslovakia, Cuba, Poland, Hungary, Mongolia, the German Democratic Republic, Romania, and the Soviet Union established this organization on 15 November 1975. Any country may join it if, at the time of affiliation, it endorses the agreement dealing with the development of radio and television program exchange among the member countries. The government of Hungary

ratified the agreement in 1972, and decided to build a ground station in 1973. The late Dr Gyorgy Csanadi, then minister of transportation and postal affairs, signed an intergovernmental agreement to this effect, which stipulated that the construction will be assisted by the Soviet Union.

One way in which this assistance has manifested itself was that the location of the facility was decided with the help of Soviet experts. The Hungarian Postal Service examined cartographically the entire country, looking for a valley where the station can be erected and where there are no residential areas in the vicinity (to provide biological security). Eleven such valleys were located in Hungary. Then, additional requirements were considered: the station must not be located in an electrical field, which might interfere with the weak signals coming from outer space; the valley must not be too deep so that the paraboloid mirror of the station can "see" and track the orbiting artificial satellite. This eliminated eight from the 11 locations initially selected. Three were left in the running: Jasd, Kovagoors, and Taliandorogd. Then, secondary aspects were considered, and finally, the choice was made. It was Taliandorogd, which is a small village near the road connecting Veszprem and Tapolca.

With Soviet Cooperation

The Elektroimpex and Prommasheksport enterprises concluded in early 1974 the agreement providing for the shipment of Soviet-made communications-engineering equipment and the Soviet participation in the designing of the Hungarian ground station. The Hungarian designer is the Design Bureau of the Postal Service; the Russian designer is the GSPI, which is the design bureau of the Postal Service of the Soviet Union. The investing organ is the Central Investment Bureau of the Postal Service; the operating organ is the Radio and Television Engineering Directorate of the Postal Service.

Construction started with the building in the spring of 1975 of the more than two kilometers long road with concrete surface between the village and the station site. The foundation work, the road structure, and the road surface was performed by the North-Transdanubian Utility and Underground Construction Enterprise. In November of the same year, the foundation of the transmitter building was completed, and a start was made with the assembly of the steel structure.

The general contractor of the technical building is the Megye Zala State Construction Enterprise. On 4 April of this year, this enterprise handed over the building for installation of the facilities. Soon, the installation of the communications equipment, which is mostly already on Hungarian

soil from the Soviet Union, will be installed. Two transmission lines will bring the electric power needed for the facility, and there will be a Diesel-powered emergency generator.

Soviet experiences were very helpful in the course of the construction work. In the Soviet Union, many similar ground stations have already been built, and Soviet experts have also participated in the construction of the Intersputnik stations in Cuba, Mongolia, the German Democratic Republic, Czechoslovakia, and Poland, which are now operational.

Cooperation between the Soviet Union and Hungary in the field of communication engineering has a tradition already: Hungary has already shipped much equipment to the Soviet Union. Here is a recent example: Soviet experts have helped in Solt to build the 2,000-kilowatt Kossuth transmitter. Stanislav Dimitrievich Pedchenko, design chief, moved from Solt to Taliandorogd. Viktor Petrovich Pashentsev, construction foreman, is already on the site. The general installation contractor, the Precision Mechanical Enterprise, has an agreement according to which Soviet engineers and technicians guide the various parts of the assembly according to an overall plan. A total of 25 specialists will come to Hungary.

According to the plan — and there is every reason to expect that it will be fulfilled on schedule — the facility will be ready to start operations by the end of the year: the Hungarian Intersputnik ground communication station in Taliandorogd will function. The expected total cost of the investment project is 400 million forints.

Leased and Owned Satellites

Much has already been said about the history of the system and the ground station; let us now discuss the technical specifications and tasks of the facility. In three shifts, a total of 60 persons will work on the station in Taliandorogd, most of them from other areas of the country. They have mostly worked in microwave stations before; almost all of them are becoming familiar with the equipment during the construction phase. Thirty-five apartments are being built for them in Tapolca, which is the nearest town.

Once completed, the Hungarian station of Intersputnik will be capable of transmitting one color or black-and-white television program, one radio program, and 60 telephone conversations. In the first stage, however, it will be able to transmit only one television and one radio program and 12 telephone conversations. The microwave connection to Budapest from Taliandorogd will be through Kabhegy and Gyor; the equipment for the relay chain is built at the Orion factory.

The countries taking an active part in the Intersputnik organization — which after the inauguration of the Taliandorogd facility will also include Hungary — will lease Molniya channels from the Soviet Union. These satellites orbit along an elongated, elliptical track around the earth. For continuous operation, three are required. The 12-meter diameter paraboloid antenna must always track the satellite, which orbits approximately 40,000 kilometers away from the surface. Tracking can be accomplished manually (but under normal conditions this is not done) or through a program (using a computer which had been fed the orbital data of the satellite) or automatically (on the basis of signals coming from space).

The geostationary satellites, which appear to hover above the earth, are simpler in this respect; for experimental purposes the Soviet Union has already launched several of these. Over the long range, this will considerably simplify the work. Once the member countries think that this is desirable and economically feasible, Intersputnik will use its own satellite.

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HUNGARY

BRIEFS

HUNGARIAN RADIATION DOSIMETERS FOR COSMONAUTS--Soviet cosmonauts are using Hungarian radiation danger detectors. The miniature dosimeter equipment was designed by researchers of the Central Physics Research Institute within the framework of the international space research agreement of the socialist countries. Because of its small size, this device--contrary to previous practice--can be used in space ships. The new instrument is used in medicine and environmental protection situations as well as in space research. [Text] [Budapest ESTI HIRLAP in Hungarian 27 Apr 77 p 3]

DEVELOPMENT OF INDUSTRIAL ROBOTS--The development of industrial robots in Hungary is the job of the Research Institute for Computer Technology and Automation of the Hungarian Academy of Sciences. Dr Laszlo Helm, department head, was recently queried about the department's work. Among other things, he said: "We have developed a medium, programmable manipulator suitable for serving machines. Its arm can move in four directions. It has a load capacity of 7.5 kilograms. It is suitable for production in series which has already begun at the Precision Assembly Factory of Eger. The control unit can be connected to the manufacturing equipment. At present a group of small manipulators which operate on an entirely new principle is being developed. Another research group is working on 'intelligent' robots. These are devices which operate or 'see' with the aid of industrial cameras or laser beams. They are suitable for adaptation and are also capable of decision making. For example, they select the appropriate parts and assemble them. [Budapest NEPSZAVA in Hungarian 1 May 77 p 12]

HIGH PROTEIN WHEAT--For 15 years the Kiszombor plant improving facility of the Grain Propagating Research Institute of Szeged has been concerned with the breeding of wheat varieties having a high protein content. The Institute has succeeding in breeding a wheat having a 16-17 percent protein content as opposed to the usual 12-14 percent. The new wheat has been named gk-Tiszataj and it is now undergoing mass testing. It is hoped that gradual propagation of the seed in future years will result in enough of the new variety to permit its admixture with regular wheat at the mills. This should improve the quality of the flour to a great extent. [Budapest ESTI HIRLAP in Hungarian 26 Apr 77 p 4]

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